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Han et al.

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(54) **ICE DISPENSING TECHNOLOGY**

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(51) **Int. Cl.**
F25C 1/00 (2006.01)
F25B 49/00 (2006.01)
B67D 7/06 (2010.01)

(52) **U.S. Cl.** **62/135**; 62/131; 222/23

(58) **Field of Classification Search** 62/131, 62/340, 441, 135; 222/52, 23, 146.6, 504; 700/275

See application file for complete search history.

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(57) **ABSTRACT**

An ice-making device includes a duct through which ice is dispensed and a duct-covering part opening and closing the duct. A sensor part senses whether the duct-covering part closes the duct and a control part controls the duct-covering part to open the duct when the sensor part senses that the duct-covering part fails to close the duct and the duct-covering part has been attempting to close the duct for at least a preset period of time.

18 Claims, 6 Drawing Sheets

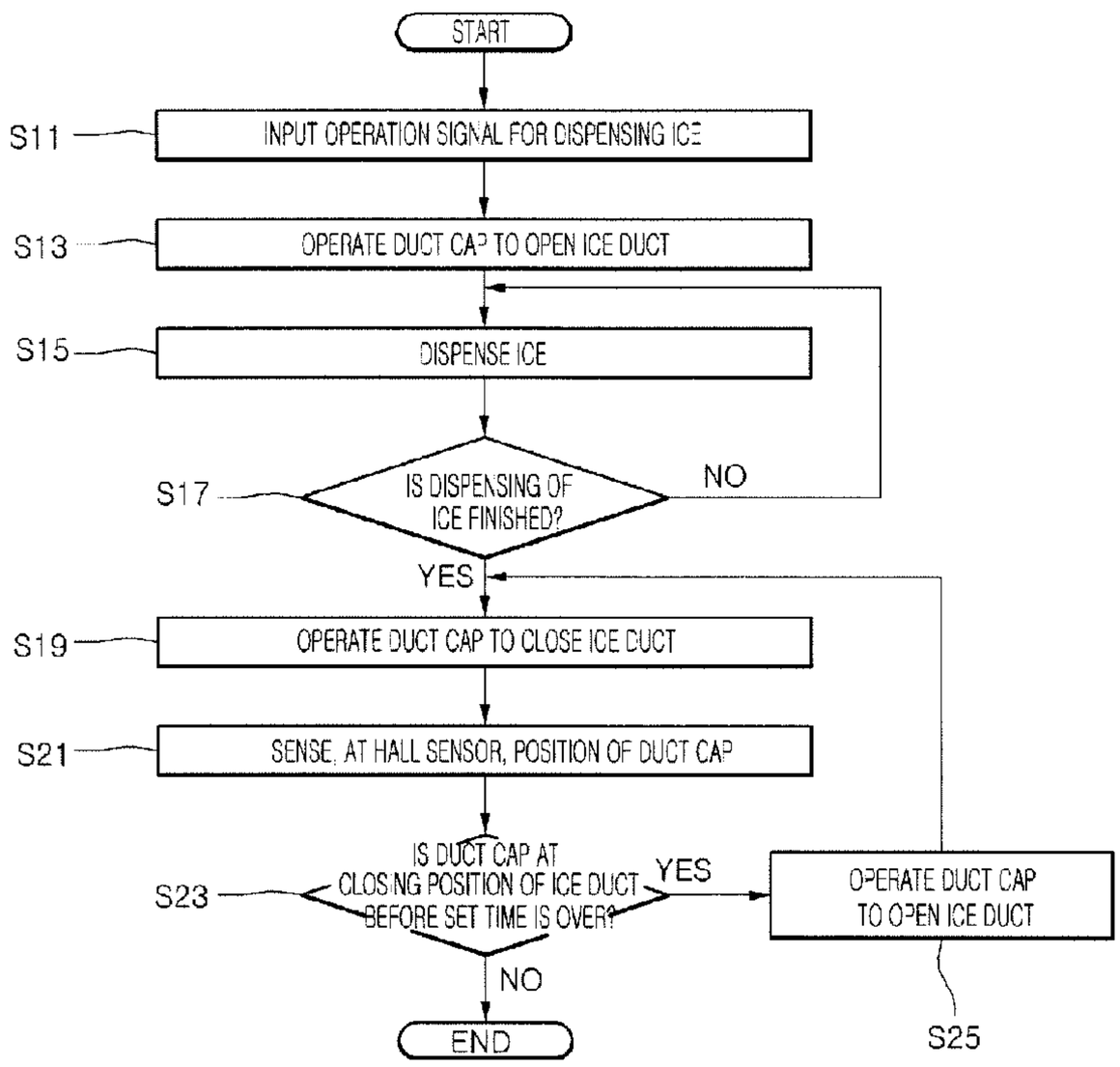


FIG.1

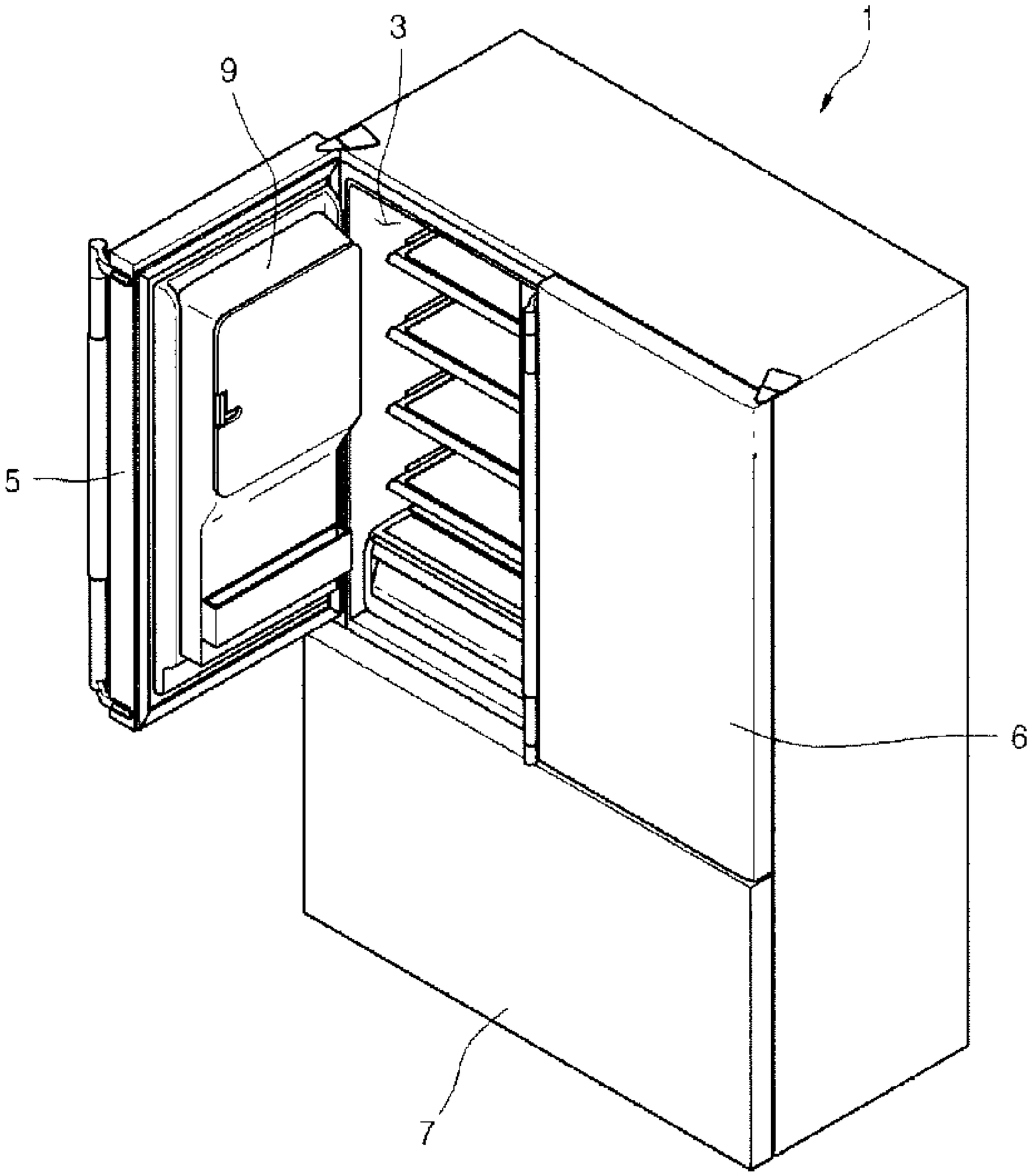


FIG. 2

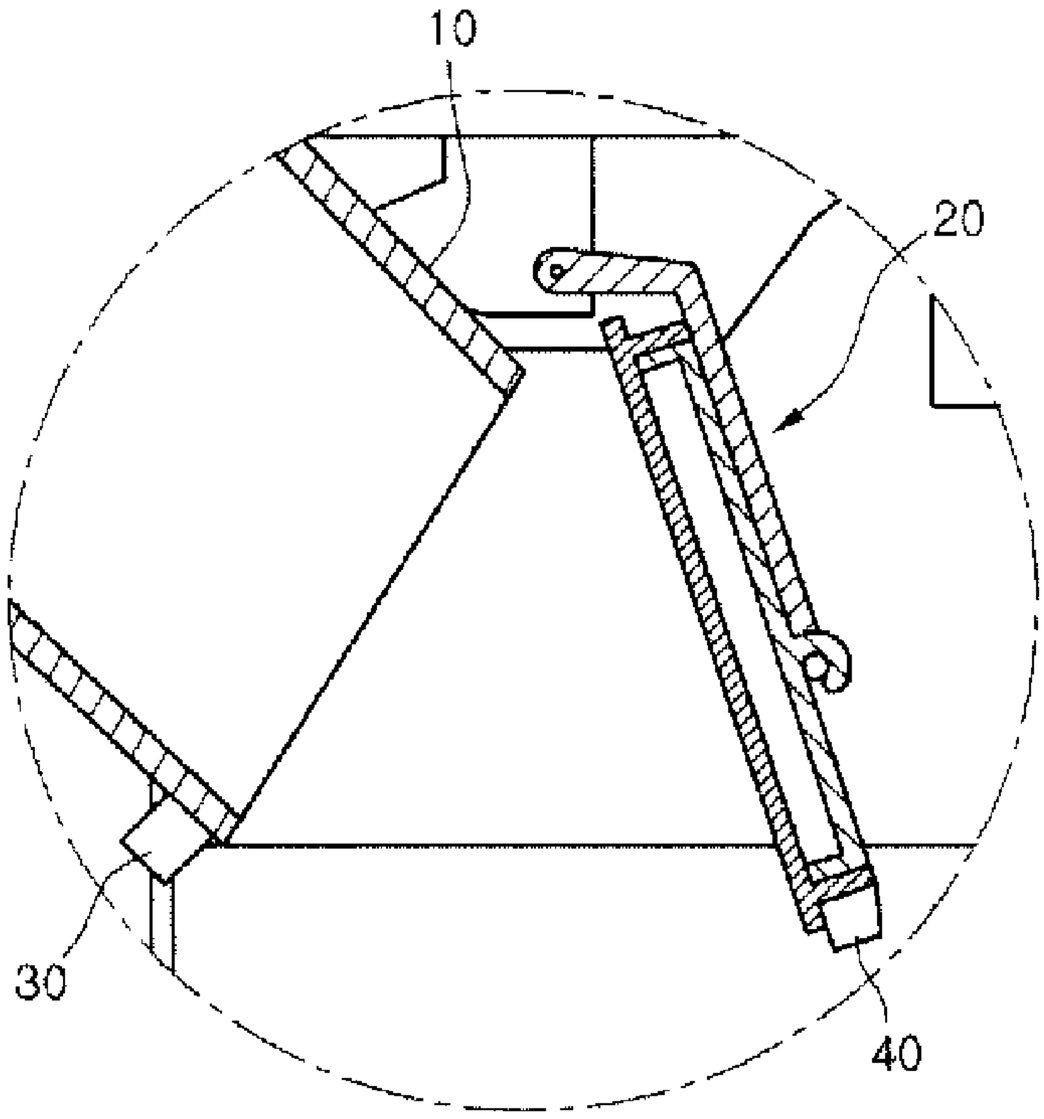

10
20
30
40

FIG. 3

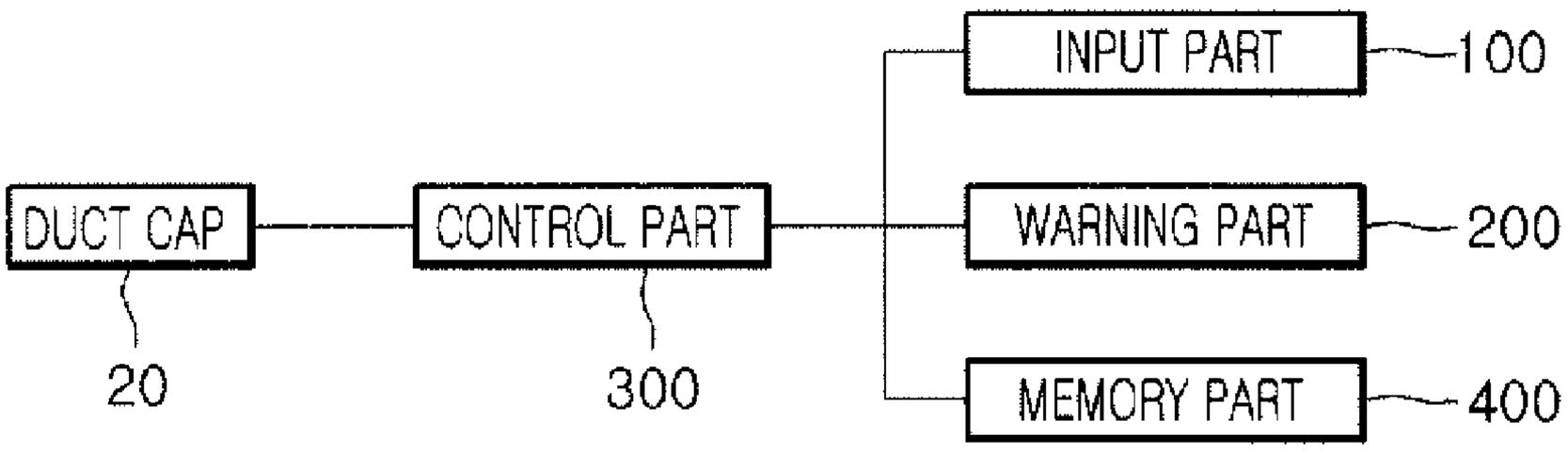

DUCT CAP
20
CONTROL PART
300
INPUT PART
100
WARNING PART
200
MEMORY PART
400

FIG. 4

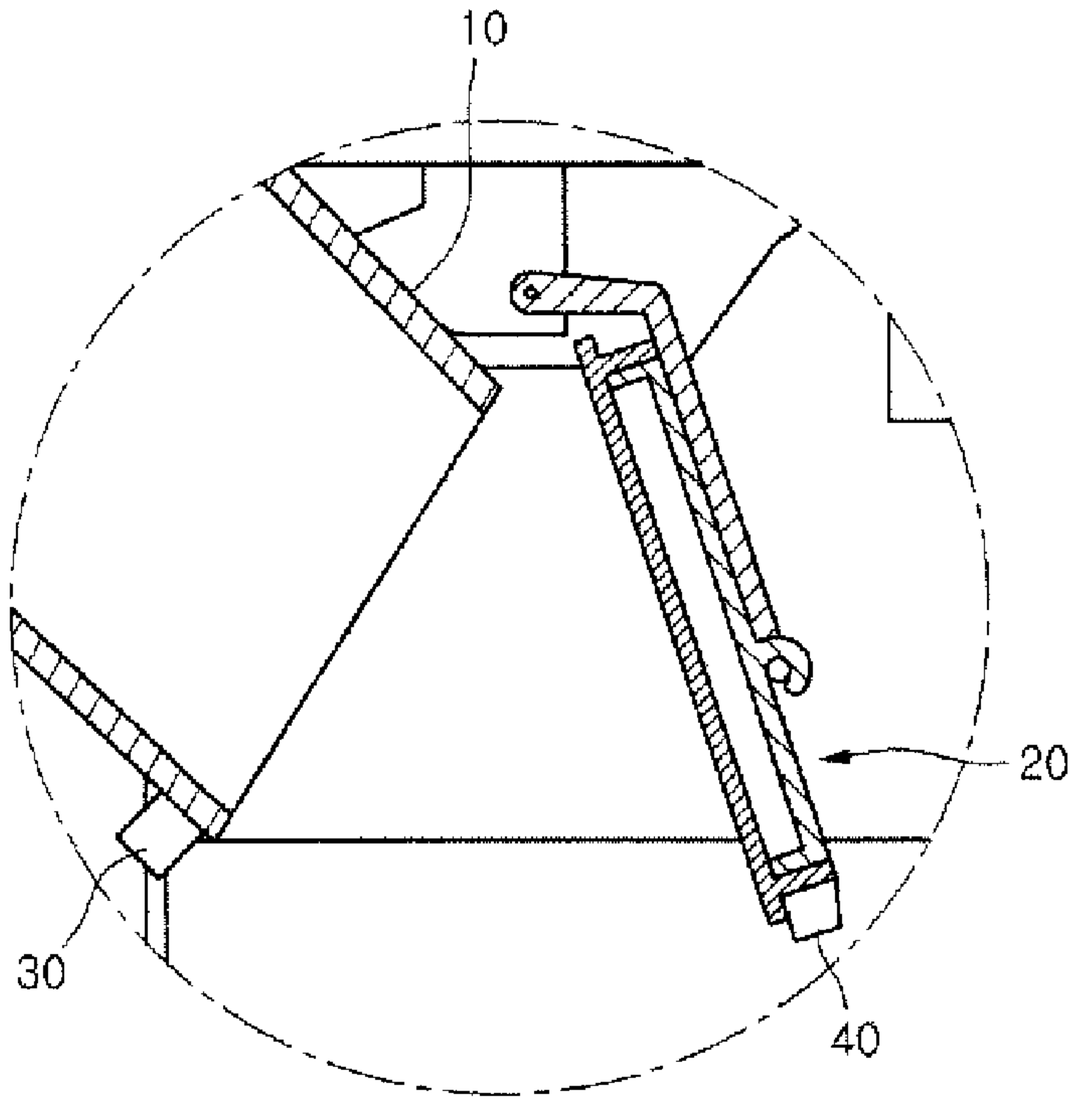


FIG. 5

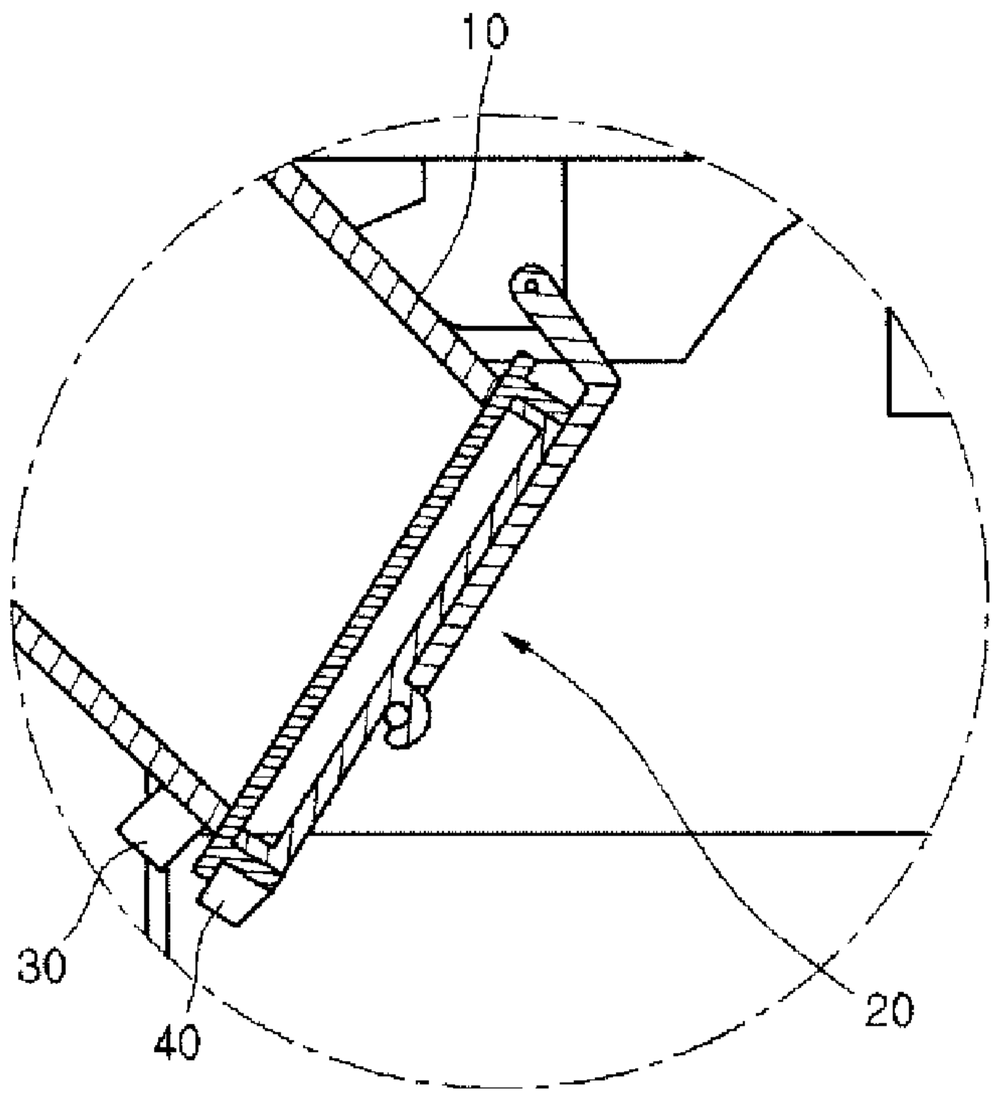


FIG.6

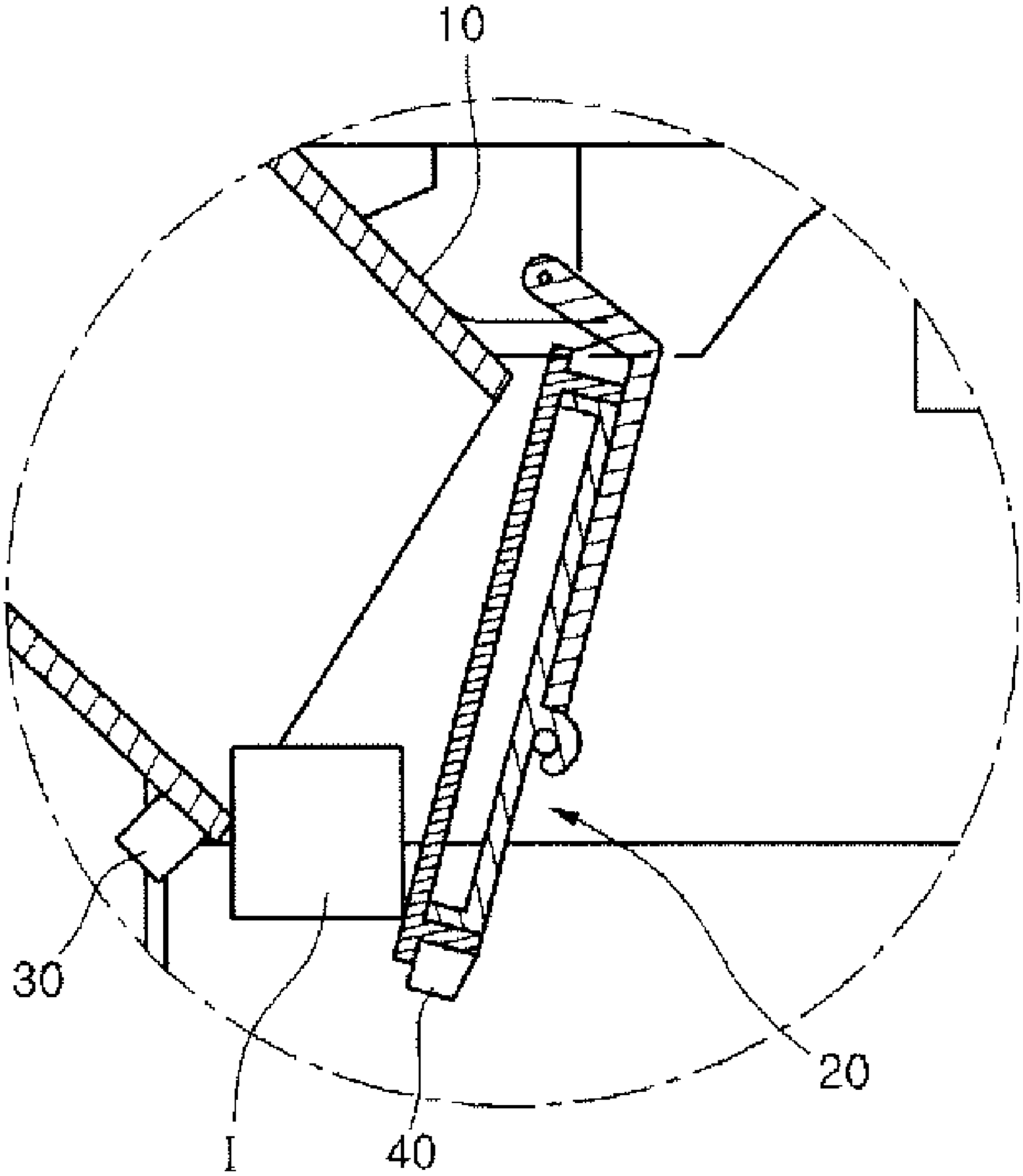


FIG.7

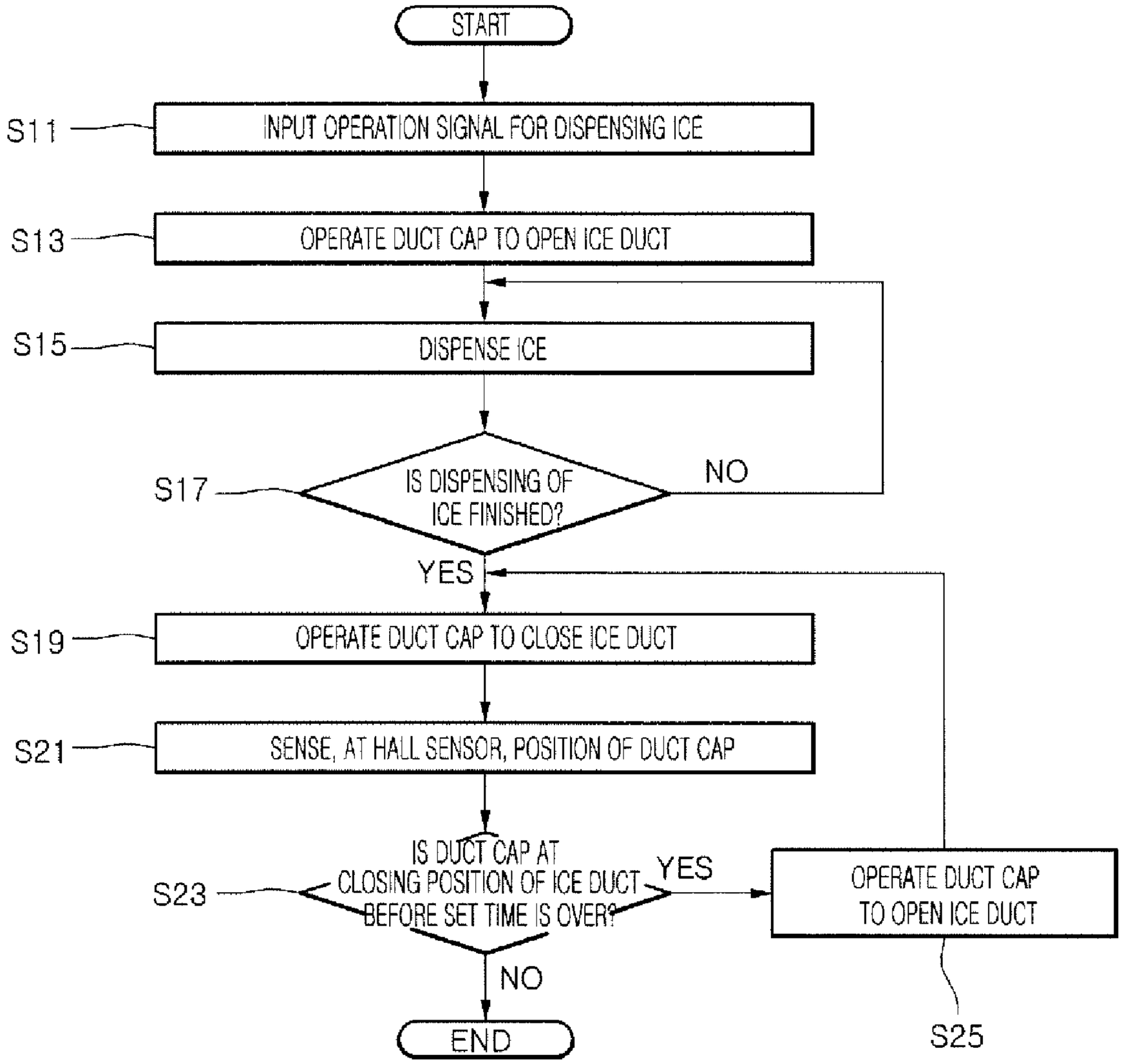
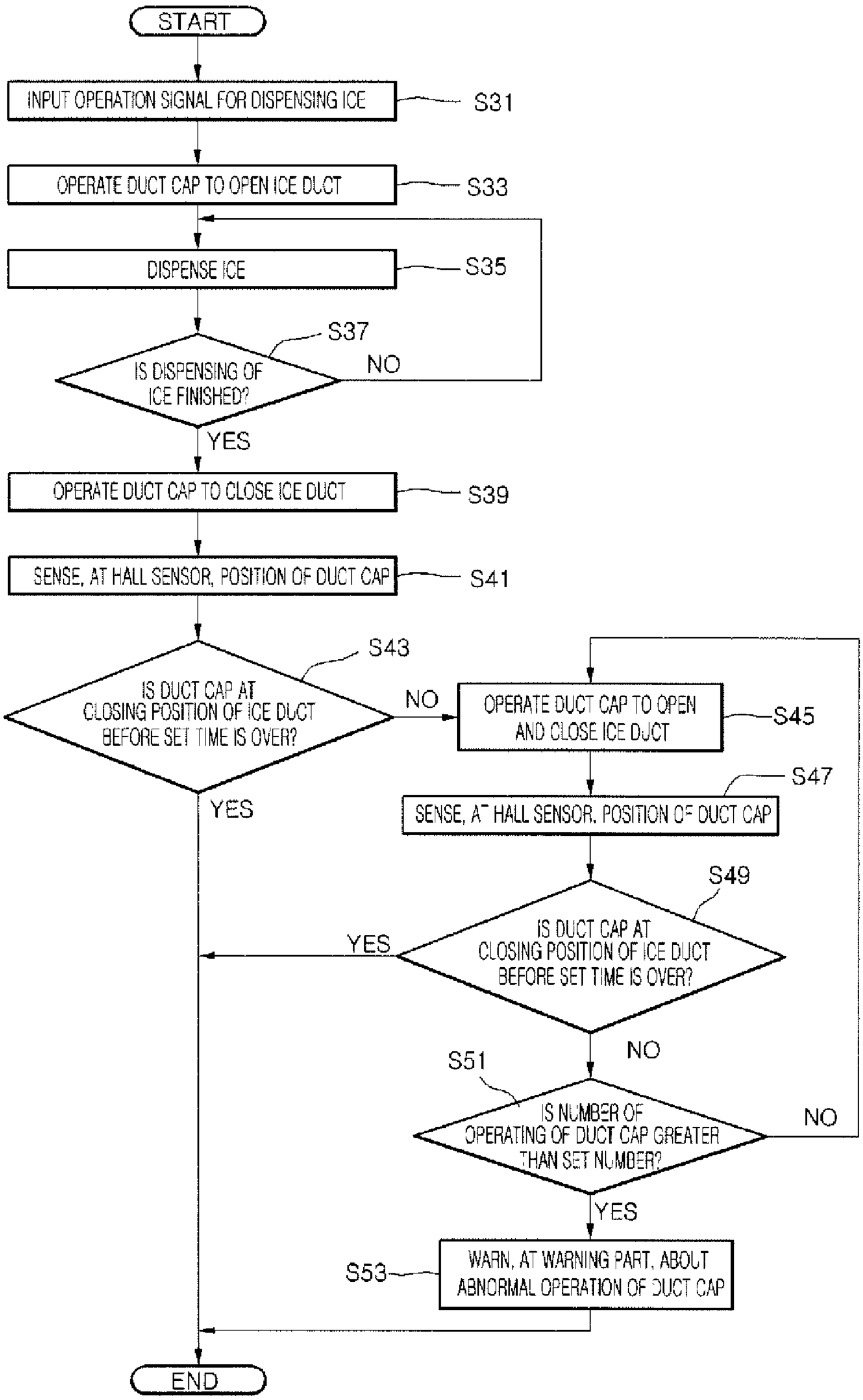

START
S11
INPUT OPERATION SIGNAL FOR DISPENSING ICE
S13
OPERATE DUCT CAP TO OPEN ICE DUCT
S15
DISPENSE ICE
S17
IS DISPENSING OF ICE FINISHED?
NO
YES
S19
OPERATE DUCT CAP TO CLOSE ICE DUCT
S21
SENSE, AT HALL SENSOR, POSITION OF DUCT CAP
S23
IS DUCT CAP AT CLOSING POSITION OF ICE DUCT BEFORE SET TIME IS OVER?
YES
NO
END
OPERATE DUCT CAP TO OPEN ICE DUCT
S25

FIG. 8


START
INPUT OPERATION SIGNAL FOR DISPENSING ICE
S31
OPERATE DUCT CAP TO OPEN ICE DUCT
S33
DISPENSE ICE
S35
S37
IS DISPENSING OF ICE FINISHED?
NO
YES
OPERATE DUCT CAP TO CLOSE ICE DUCT
S39
SENSE, AT HALL SENSOR, POSITION OF DUCT CAP
S41
S43
IS DUCT CAP AT CLOSING POSITION OF ICE DUCT BEFORE SET TIME IS OVER?
NO
YES
OPERATE DUCT CAP TO OPEN AND CLOSE ICE DUCT
S45
S47
SENSE, AT HALL SENSOR, POSITION OF DUCT CAP
S49
IS DUCT CAP AT CLOSING POSITION OF ICE DUCT BEFORE SET TIME IS OVER?
YES
NO
S51
IS NUMBER OF OPERATING OF DUCT CAP GREATER THAN SET NUMBER?
NO
YES
S53
WARN, AT WARNING PART, ABOUT ABNORMAL OPERATION OF DUCT CAP
END

ICE DISPENSING TECHNOLOGY

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority under 35 U.S.C. 119 and 35 U.S.C. 365 to Korean Patent Application No. 10-2008-0113685 (filed on Nov. 14, 2008), which is hereby incorporated by reference in its entirety.

FIELD

The present disclosure relates to ice dispensing technology.

BACKGROUND

A refrigerator is a home appliance that can store foods in a freezing state or a refrigeration state. A refrigerator may include a dispenser that can dispense ice and/or water to an outside of the refrigerator. The refrigerator provided with the dispenser includes devices for making and dispensing the ice.

SUMMARY

In one aspect, an ice-making device includes a duct through which ice is dispensed, a duct-covering part configured to open and close the duct, and a sensor part configured to sense whether the duct-covering part is positioned to close the duct. The ice-making device also includes a control part configured to control the duct-covering part to open the duct when the sensor part senses that the duct-covering part fails to close the duct and the duct-covering part has been attempting to close the duct for at least a preset period of time.

Implementations may include one or more of the following features. For example, the sensor part may include a magnet coupled to one of a side of the duct and a side of the duct-covering part and a hall sensor that is coupled to the other of the side of the duct and the side of the duct-covering part and that is configured to sense a magnetic field of the magnet. The magnet and the hall sensor may be positioned such that, when the duct-covering part is positioned to close the duct, the magnet and the hall sensor contact and, when the duct-covering part is positioned to open the duct, the magnet and the hall sensor fail to contact.

In some implementations, the duct-covering part may include a duct cap and a cap motor configured to rotate the duct cap to open and close the duct. In these implementations, the control part may be configured to rotate the cap motor in a first direction to cause the cap motor to rotate the duct cap to open the duct and rotate the cap motor in a second direction to cause the cap motor to rotate the duct cap to close the duct. The second direction may be different than the first direction.

In another aspect, an ice-making device includes a duct through which ice is dispensed, a duct-covering part configured to open and close the duct, and a sensor part configured to sense a position of the duct-covering part relative to the duct. The ice-making device also includes a control part configured to control the duct-covering part to repeat at least once an operation of opening and closing the duct when the sensor part senses that the duct-covering part fails to reach a closing position in which the duct-covering part closes the duct and the duct-covering part has been attempting to close the duct for at least a preset period of time.

Implementations may include one or more of the following features. For example, the control part may be configured to, after controlling the duct-covering part to repeat the operation of opening and closing the duct, reduce the preset period of time used in determining whether to repeat the operation of opening and closing the duct. The control part may be configured to gradually reduce the preset period of time used in determining whether to repeat the operation of opening and closing the duct each time the operation of opening and closing the duct is repeated.

The ice-making device may include a warning part configured to output a warning to a user. The control part may be configured to determine whether the operation of opening and closing the duct has been repeated a preset number of times and control the warning part to output the warning in response to a determination that the operation of opening and closing the duct has been repeated the preset number of times.

The sensor part may include a magnet coupled to one of a side of the duct and a side of the duct-covering part and a hall sensor that is coupled to the other of the duct and the side of the duct-covering part and that is configured to sense a magnetic field of the magnet. The magnet and the hall sensor may be positioned such that, when the duct-covering part is positioned to close the duct, the magnet and the hall sensor contact and, when the duct-covering part is positioned to open the duct, the magnet and the hall sensor fail to contact.

In some implementations, the duct-covering part may include a duct cap and a cap motor configured to rotate the duct cap to open and close the duct. In these implementations, the control part may be configured to rotate the cap motor in a first direction to cause the cap motor to rotate the duct cap to open the duct and rotate the cap motor in a second direction to cause the cap motor to rotate the duct cap to close the duct. The second direction may be different than the first direction.

The sensor part may include a magnet coupled to a side of the duct-covering part and a hall sensor that is configured to sense a magnetic field of the magnet and that is configured to sense whether the duct-covering part is in a position to close the duct based on whether the magnetic field of the magnet is relatively weak or relatively strong.

In yet another aspect, a method of controlling an ice-making device includes controlling, using a control part, a duct-covering part to open a duct to allow dispensing of ice. Subsequent to dispensing ice through the duct, the method includes controlling, using the control part, the duct-covering part to close the duct. In response to controlling the duct-covering part to close the duct, the method includes sensing, using a sensor part, whether the duct-covering part is in a position that closes the duct and determining, using the control part, whether a preset period of time has passed since controlling the duct-covering part to close the duct. In response to sensing that the duct-covering part is not in a position that closes the duct and determining that the preset period of time has passed since controlling the duct-covering part to close the duct, the method includes controlling, using the control part, the duct-covering part to reopen the duct.

Implementations may include one or more of the following features. For example, the method may include controlling, using the control part, the duct-covering part to attempt to close the duct again after controlling the duct-covering part to reopen the duct. The method also may include controlling, using the control part, the duct-covering part to repeatedly open the duct and attempt to close the duct until the sensor part senses that the duct-covering part is in a position that closes the duct prior to the control part determining that the duct-covering part has been attempting to close the duct for the preset period of time.

Further, the method may include determining, using the control part, whether, in attempting to close the duct, an operation to open and close the duct has been repeated a

preset number of times and using the control part to stop controlling the duct-covering part to repeatedly open the duct and attempt to close the duct in response to a determination that an operation to open and close the duct has been repeated the preset number of times. After controlling the duct-covering part to repeat an operation of opening and closing the duct, the method may include reducing the preset period of time used in determining whether to repeat the operation of opening and closing the duct. The method may include gradually reducing the preset period of time used in determining whether to repeat the operation of opening and closing the duct each time the operation of opening and closing the duct is repeated.

In some implementations, the duct-covering part may include a duct cap and a cap motor configured to rotate the duct cap to open and close the duct. In these implementations, the method may include controlling, using the control part, the cap motor to rotate in a first direction to cause the cap motor to rotate the duct cap to open the duct, and controlling, using the control part, the cap motor to rotate in a second direction to cause the cap motor to rotate the duct cap to close the duct. The second direction may be different than the first direction.

In some examples, the method may include determining, using the control part, whether, in attempting to close the duct, an operation to open and close the duct has been repeated a preset number of times, and outputting, using a warning part, a warning to a user in response to a determination that an operation to open and close the duct has been repeated the preset number of times.

The details of one or more implementations are set forth in the accompanying drawings and the description below. Other features will be apparent from the description and drawings, and from the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view illustrating a refrigerator with an ice-making device.

FIG. **2** is a cross-sectional view illustrating a part of an ice-making device.

FIG. **3** is a block diagram illustrating configuration of an ice dispensing control system.

FIGS. **4** to **6** are views illustrating operation of an ice-making device.

FIG. **7** is a flowchart illustrating a method of controlling an ice-making device.

FIG. **8** is a flowchart illustrating a method of controlling an ice-making device.

DETAILED DESCRIPTION

FIG. **1** illustrates an example of a refrigerator with an ice-making device. FIG. **2** illustrates a cross-section of an example of a part of an ice-making device. FIG. **3** illustrates an example configuration of an ice dispensing control system.

Referring to FIG. **1**, a refrigerator compartment **3** and a freezer compartment are disposed in a main body **1**. The refrigerator compartment **3** and the freezer compartment, where foods are stored, are arranged vertically in the main body **1**, with the refrigerator compartment **3** being positioned above the freezer compartment. The refrigerator compartment **3** is opened and closed by refrigerator compartment doors **5** and **6** and the freezer compartment is opened and closed by a freezer compartment door **7**.

An ice-making chamber **9** is provided to an inner surface of the refrigerator compartment door **5** (hereinafter, referred to as a "door"). The ice-making chamber **9** is separated from the refrigerator compartment **3**, and an ice-making device (not shown) for making ice is disposed in the ice-making chamber **9**.

A front surface of the door **5** is provided with a dispenser (not shown). The dispenser is used to dispense water and/or ice without opening the door **5**.

Referring to FIG. **2**, an ice duct **10** is disposed in the door **5**. The ice duct **10** is used to dispense ice made by the ice-making device to an outside of the refrigerator, that is, to the outside of the refrigerator through the dispenser which transports ice through the door **5** when the door **5** is in a closed positioned. To this end, a first end of the ice duct **10** communicates with the ice-making device and a second end of the ice duct **10** communicates with the dispenser.

A duct cap **20** opens and closes an end of the ice duct **10** adjacent to the dispenser (e.g., the second end of the ice duct **10** that communicates with the dispenser). One end of the duct cap **20** rotates about the other end to open and close the ice duct **10**. For example, the duct cap **20** may be rotated by a solenoid valve or a motor.

The ice duct **10** and the duct cap **20** are provided with a hall sensor **30** and a magnet **40**, respectively. In the state where the duct cap **20** closes the ice duct **10**, the hall sensor **30** and the magnet **40** may be disposed at a position where the ice duct **10** faces the duct cap **20**. The hall sensor **30** and the magnet **40** sense a position of the duct cap **20** relative to the ice duct **10**. More particularly, the hall sensor **30** provided to the ice duct **10** senses strength (e.g., presence or absence) of a magnetic field of the magnet **40** provided to the duct cap **20** and, thereby, senses the position of the duct cap **20** relative to the ice duct **10**. When the duct cap **20** closes the ice duct **10**, the hall sensor **30** senses a relatively strong (e.g., a present) magnetic field and detects that the duct cap **20** is in a position to close the ice duct **10**. When the duct cap **20** opens the ice duct **10**, the hall sensor **30** senses a relatively weak (e.g., an absent) magnetic field and detects that the duct cap **20** is in a position to open the ice duct **10**.

Referring to FIG. **3**, an input part **100** receives an operation signal for dispensing ice through the dispenser. A warning part **200** displays whether the duct cap **20** is in abnormal operation. The warning part **200** may display the abnormal operation of the duct cap **20** using a lamp on/off, display of characters or symbols, any type of visual display, or an audible output (e.g., a voice output).

A control part **300** (e.g., an electronic controller, a processor, etc.) controls the dispensing of ice through the dispenser. For instance, the control part **300** rotates the duct cap **20** to close or open the ice duct **10** according to an operation signal input to the input part **100**.

When abnormal operation of the duct cap **20** is sensed when the duct cap **20** is attempting to close the ice duct **10**, the control part **300** controls the duct cap **20** to open the ice duct **10**. In some implementations, the control part **300** controls the duct cap **20** to repeat opening and closing operation of the ice duct **10** at least one time until the duct cap **20** operates normally. Abnormal operation of the duct cap **20** is detected when the hall sensor **30** fails to sense that the duct cap **20** is moved from a position where the duct cap **20** opens the ice duct **10** to a closing position for at least a preset time during which the duct cap **20** is attempting to close the ice duct **10**. The abnormal operation of the duct cap **20** may be detected when an operation time for the duct cap **20** to rotate from the position where the duct cap **20** opens the ice duct **10** to the position where the duct cap **20** closes the ice duct **10** is greater than the preset time. For example, when ice is caught between the ice duct **10** and the duct cap **20**, the duct cap **20** fails to

close the ice duct **10** completely. Thus, the hall sensor **30** fails to sense that the duct cap **20** arrives at the position where the duct cap **20** closes the ice duct **10** from the open position prior to the operation time expiring.

When an abnormal operation of the duct cap **20** is sensed and the duct cap **20** repeats the opening and closing operation for the ice duct **10**, the control part **300** controls the duct cap **20** to gradually reduce the operation time of the duct cap **20**. For instance, as the repeated number of opening and closing operations of the duct cap **20** for the ice duct **10** increases, possibility that a foreign substance is removed between the ice duct **10** and the duct cap **20** also increases. Thus, gradually reducing the opening and closing time of the duct cap **20** for the ice duct **10** reduces an amount of air in the ice-making device that escapes through the ice duct **10** to the outside by the rotation of the duct cap **20** opening and closing the ice duct **10**. In this regard, leakage of cold air from the ice-making chamber may be reduced when attempting to correct abnormal operation of the duct cap **20**.

When the operation of the duct cap **20** opening and closing the ice duct **10** is repeated a preset number of times and the hall sensor **30** still fails to sense that the duct cap **20** moves from the position where the duct cap **20** opens the ice duct **10** to the closing position before the set time is over, the control part **300** controls the warning part **200** to provide a warning indicating abnormal operation of the duct cap **20**. Providing the warning may alert a user to the abnormal operation of the duct cap **20** and, thereby, allow the user to correct the abnormal operation (e.g., remove an ice piece that is preventing the duct cap **20** from closing). This may result in correction of the abnormal operation more quickly and, therefore, reduce an amount of cold air that leaks from the ice-making chamber due to the abnormal operation.

The set time and the set number of times are stored in a memory part **400** (e.g., a random access memory, read only memory, or any type of electronic storage device) and may be user-configurable. The memory part **400** may store the operation times of the duct cap **20** depending on the set number.

FIGS. **4** to **6** illustrate example operation of an ice-making device. Referring to FIG. **4**, the input part **100** (refer to FIG. **3**) receives an operation signal for dispensing ice through the dispenser, and the control part **300** (refer to FIG. **3**) controls the duct cap **20** to rotate to open the ice duct **10** in response to the operation signal for dispensing ice through the dispenser. Thus, the ice made at the ice-making device is dispensed through the ice duct **10**. At this point, the hall sensor **30** senses that the magnetic field of the magnet **40** of the duct cap **20** is relatively weak (e.g., absent or less than a threshold), and thus senses that the duct cap **20** is disposed at the position of opening the ice duct **10**.

Referring to FIG. **5**, when the dispensing of the ice through the ice duct **10** is finished, the control part **300** controls the duct cap **20** to rotate to close the ice duct **10**. Thus, the ice duct **10** is closed to finish the dispensing of the ice through the ice duct **10**. At this point, the hall sensor **30** senses that the magnetic field of the magnet **40** of the duct cap **20** is relatively strong (e.g., present or greater than a threshold), and thus senses the duct cap **20** is disposed at the position of closing the ice duct **10**.

While the control part **300** controls the duct cap **20** to close the ice duct **10**, when an ice piece I is caught between the ice duct **10** and the duct cap **20**, the duct cap **20** fails to close the ice duct **10** completely. Thus, the hall sensor **30** senses that the magnetic field of the magnet **40** of the duct cap **20** is relatively weak (e.g., absent or less than a threshold) and thus senses that the duct cap **20** is not disposed at the position of closing the ice duct **10**. Based on detecting that the duct cap **20** is not disposed at the position of closing the ice duct **10**, the control part **300** controls the duct cap **20** to rotate to open the ice duct **10** or controls the duct cap **20** to rotate to open and close the ice duct **10** a set number of times.

FIG. **7** illustrates an example of a method of controlling an ice-making device. Referring to FIG. **7**, the input part **100** receives an operation signal starting the dispensing of ice through the dispenser (S**11**). The input part **100** may receive the operation signal starting the dispensing of the ice through the dispenser by receiving a user's press of an operation button (not shown) or receiving a user's press of a lever (not shown) with a container for receiving ice.

When the dispensing of the ice starts (S**11**), the control part **300** controls the operation of the duct cap **20** to open the ice duct **10** (S**13**). After the ice duct **10** is opened by the duct cap **20** (S**13**), the ice is dispensed through the ice duct **10** (S**15**).

Then, it is determined whether the dispensing of the ice through the ice duct **10** is finished (S**17**). For example, whether the dispensing of the ice through the ice duct **10** is finished may be determined according to whether the input part **100** receives an operation signal finishing the dispensing of the ice, according to whether the input part **100** further receives the operation signal for dispensing the ice (e.g., whether a user continues to supply a constant pressing force to a dispensing control button or lever), or according to whether the time for dispensing the ice, set according to the operation signal dispensing the ice and input to the input part **100**, is finished.

When it is determined that the dispensing of the ice through the ice duct **10** is finished (S**17**), the control part **300** controls the operation of the duct cap **20** to close the ice duct **10** (S**19**). Thus, the duct cap **20** operates to close the ice duct **10**.

When the duct cap **20** starts to operate to close the ice duct **10** (S**19**), the hall sensor **30** senses a position of the duct cap **20**, e.g., a position of the duct cap **20** relative to the ice duct **10** (S**21**). The sensing of the position of the duct cap **20** (S**21**) is performed by sensing, at the hall sensor **30**, a magnetic field of the magnet **40** of the duct cap **20**.

Based on the sensing (S**21**), it is determined whether the hall sensor **30** senses that the duct cap **20** has moved to the closing position from the position where the duct cap **20** opens the ice duct **10** prior to a set time expiring (S**23**) When it is determined that the hall sensor **30** senses that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**23**), the duct cap **20** has operated normally to close the ice duct **10**, and thus the operation of the duct cap **20** is finished.

When it is determined that the hall sensor **30** fails to sense that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**23**), the control part **300** controls the duct cap **20** to operate to open the ice duct **10** (S**25**). Then, the control part **300** controls the duct cap **20** such that operations associated with reference numerals (S**19**) to (S**23**) are repeated.

FIG. **8** illustrates an example of a method of controlling an ice-making device. Referring to FIG. **8**, the input part **100** receives an operation signal starting the dispensing of ice through the dispenser (S**31**). Then, according to the operation signal input to the input part **100**, the control part **300** controls the duct cap **20** to open the ice duct **10** (S**33**), so that the ice is dispensed through the ice duct **10** (S**35**).

It is determined whether the dispensing of the ice through the ice duct **10** is finished (S**37**). When it is determined that the dispensing of the ice through the ice duct **10** is finished, the control part **300** controls the duct cap **20** to close the ice duct **10** (S**39**).

When the duct cap **20** starts to operate to close the ice duct **10** (S**39**), the hall sensor **30** senses a position of the duct cap **20**, e.g., a position of the duct cap **20** relative to the ice duct **10** (S**41**). Based on the sensing (S**41**), it is determined whether the hall sensor **30** senses that the duct cap **20** has moved to the closing position from the position where the duct cap **20** opens the ice duct **10** prior to a set time expiring (S**43**). When it is determined that the hall sensor **30** senses that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**43**), the duct cap **20** has operated normally to close the ice duct **10**, and thus the operation of the duct cap **20** is finished.

When it is determined that the hall sensor **30** fails to sense that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**43**), the control part **300** controls the duct cap **20** to operate to open and close the ice duct **10** (S**45**). The hall sensor **30** senses a position of the duct cap **20** (S**47**), e.g., a position of the duct cap **20** relative to the ice duct **10**, and it is determined whether the hall sensor **30** senses that the duct cap **20** has moved to the closing position from the position where the duct cap **20** opens the ice duct **10** prior to the set time expiring (S**49**).

When it is determined that the hall sensor **30** senses that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**49**), the duct cap **20** has operated normally to close the ice duct **10**, and thus the operation of the duct cap **20** is finished.

When it is determined that the hall sensor **30** fails to sense that the duct cap **20** is disposed at the closing position prior to the set time expiring (S**49**), it is determined whether the number of repeated opening and closing operations of the duct cap **20** is greater than a preset number (S**51**). When it is determined that the number of the repeated opening and closing operations of the duct cap **20** is the preset number or less (S**51**), the control part **300** controls the duct cap **20** such that operations associated with reference numerals (S**45**) to (S**51**) are repeated.

When it is determined that the number of the repeated opening and closing operations of the duct cap is greater than the preset number (S**51**), the control part **300** controls the warning part **200** to warn about abnormal operation of the duct cap **20** (S**53**). The warning part **200** may warn through a lamp on/off, display of characters or symbols, any type of visual display, or an audible output (e.g., a voice output).

Although the ice-making device has been described as being installed in the ice-making chamber disposed on a back surface of the refrigerator compartment door, the present disclosure is not limited thereto. For example, the ice-making device may be installed in an ice-making chamber located inside of the refrigerator compartment door (e.g., within a storage space defined by the refrigerator compartment and separate from the door). Also, the ice-making device may be installed on a back surface of a freezer compartment door or located inside of the freezer compartment door (e.g., within a storage space defined by the freezer compartment and separate from the door).

Although the duct cap has been described as rotating to open or close the ice duct, the duct cap **20** is not limited to a rotating operation to open or close the ice duct. For example, the duct cap may be translated (e.g., slid) to open or close the ice duct.

The ice duct is a member for dispensing the ice, and the duct cap is a member for opening or closing the member for dispensing the ice. Thus, if the above-described functions can be performed, members and/or devices under any names may be substantially denoted as the same configuration as the ice duct and the duct cap.

In some examples, times in which the duct cap fails to close the ice duct because of ice caught between the ice duct and the duct cap may be reduced. This makes it possible to reduce cool air in the refrigerator compartment and the ice-making chamber from being discharged through the ice duct to the outside.

Also, a user may be warned when the duct cap fails to close the ice duct completely even when the operation of the duct cap for opening and closing the ice duct is performed a plurality of times. Thus, the user can remove ice between the ice duct and the duct cap. This may improve operation reliability and efficiency of the dispenser.

It will be understood that various modifications may be made without departing from the spirit and scope of the claims. For example, advantageous results still could be achieved if steps of the disclosed techniques were performed in a different order and/or if components in the disclosed systems were combined in a different manner and/or replaced or supplemented by other components. Accordingly, other implementations are within the scope of the following claims.

What is claimed is:

1. An ice-making device comprising:

a duct through which ice is dispensed;

a duct-covering part configured to open and close the duct;

a sensor part configured to sense whether the duct-covering part is positioned to close the duct; and

a control part configured to control the duct-covering part to open the duct when the sensor part senses that the duct-covering part fails to close the duct and the duct-covering part has been attempting to close the duct for at least a preset period of time,

wherein the sensor part comprises:

a magnet coupled to one of a side of the duct and a side of the duct-covering part; and

a hall sensor that is coupled to the other of the side of the duct and the side of the duct-covering part and that is configured to sense a magnetic field of the magnet.

2. The ice-making device according to claim **1**, wherein

the magnet and the hall sensor are positioned such that, when the duct-covering part is positioned to close the duct, the magnet and the hall sensor contact and, when the duct-covering part is positioned to open the duct, the magnet and the hall sensor fail to contact.

3. The ice-making device according to claim **1**, wherein the duct-covering part comprises:

a duct cap; and

a cap motor configured to rotate the duct cap to open and close the duct.

4. The ice-making device according to claim **3**, wherein the control part is configured to rotate the cap motor in a first direction to cause the cap motor to rotate the duct cap to open the duct and rotate the cap motor in a second direction to cause the cap motor to rotate the duct cap to close the duct, the second direction being different than the first direction.

5. An ice-making device comprising:

a duct through which ice is dispensed;

a duct-covering part configured to open and close the duct;

a sensor part configured to sense a position of the duct-covering part relative to the duct; and

a control part configured to control the duct-covering part to repeat at least once an operation of opening and closing the duct when the sensor part senses that the duct-covering part fails to reach a closing position in which the duct-covering part closes the duct and the duct-covering part has been attempting to close the duct for at least a preset period of time,

wherein the sensor part comprises:

a magnet coupled to one of a side of the duct and a side of the duct-covering part; and

a hall sensor that is coupled to the other of the duct and the side of the duct-covering part and that is configured to sense a magnetic field of the magnet, the magnet and the hall sensor being positioned such that, when the duct-covering part is positioned to open the duct, the sensor part fails to sense.

6. The ice-making device according to claim **5**, wherein the control part is configured to, after controlling the duct-covering part to repeat the operation of opening and closing the duct, reduce the preset period of time used in determining whether to repeat the operation of opening and closing the duct.

7. The ice-making device according to claim **6** wherein the control part is configured to gradually reduce the preset period of time used in determining whether to repeat the operation of opening and closing the duct each time the operation of opening and closing the duct is repeated.

8. The ice-making device according to claim **5**, further comprising a warning part configured to output a warning to a user,

wherein the control part is configured to determine whether the operation of opening and closing the duct has been repeated a preset number of times and control the warning part to output the warning in response to a determination that the operation of opening and closing the duct has been repeated the preset number of times.

9. The ice-making device according to claim **5**, wherein

the magnet and the hall sensor are positioned such that, when the duct-covering part is positioned to close the duct, the magnet and the hall sensor contact and, when the duct-covering part is positioned to open the duct, the magnet and the hall sensor fail to contact.

10. The ice-making device according to claim **5**, wherein the duct-covering part comprises:

a duct cap; and

a cap motor configured to rotate the duct cap to open and close the duct.

11. The ice-making device according to claim **10**, wherein the control part is configured to rotate the cap motor in a first direction to cause the cap motor to rotate the duct cap to open the duct and rotate the cap motor in a second direction to cause the cap motor to rotate the duct cap to close the duct, the second direction being different than the first direction.

12. The ice-making device according to claim **5**, wherein

hall sensor is configured to sense whether the duct-covering part is in a position to close the duct based on whether the magnetic field of the magnet is relatively weak or relatively strong.

13. A method of controlling an ice-making device, comprising:

controlling, using a control part, a duct-covering part to open a duct to allow dispensing of ice;

subsequent to dispensing ice through the duct, controlling, using the control part, the duct-covering part to close the duct;

in response to controlling the duct-covering part to close the duct:

sensing, using a sensor part, whether the duct-covering part is in a position that closes the duct; and

determining, using the control part, whether a preset period of time has passed since controlling the duct-covering part to close the duct; and

in response to sensing that the duct-covering part is not in a position that closes the duct and determining that the preset period of time has passed since controlling the duct-covering part to close the duct, controlling, using the control part, the duct-covering part to reopen the duct

controlling, using the control part, the duct-covering part to repeatedly open the duct and attempt to close the duct until the sensor part senses that the duct-covering part is in a position that closes the duct;

determining, using the control part, whether, in attempting to close the duct, an operation to open and close the duct has been repeated a preset number of times; and

using the control part to stop controlling the duct-covering part to repeatedly open the duct and attempt to close the duct in response to a determination that an operation to open and close the duct has been repeated the preset number of times.

14. The method according to claim **13**, further comprising, after controlling the duct-covering part to repeat an operation of opening and closing the duct, reducing the preset period of time used in determining whether to repeat the operation of opening and closing the duct.

15. The method according to claim **14** wherein reducing the preset period of time used in determining whether to repeat the operation of opening and closing the duct comprises gradually reducing the preset period of time used in determining whether to repeat the operation of opening and closing the duct each time the operation of opening and closing the duct is repeated.

16. The method according to claim **13**, wherein:

the duct-covering part comprises a duct cap and a cap motor configured to rotate the duct cap to open and close the duct,

controlling the duct-covering part to open the duct to allow dispensing of ice comprises controlling, using the control part, the cap motor to rotate in a first direction to cause the cap motor to rotate the duct cap to open the duct, and

controlling the duct-covering part to close the duct comprises controlling, using the control part, the cap motor to rotate in a second direction to cause the cap motor to rotate the duct cap to close the duct, the second direction being different than the first direction.

17. The method according to claim **13**, further comprising:

determining, using the control part, whether, in attempting to close the duct, an operation to open and close the duct has been repeated a preset number of times;

outputting, using a warning part, a warning to a user in response to a determination that an operation to open and close the duct has been repeated the preset number of times.

18. The method according to claim **13**, wherein the sensor part comprises:

a magnet coupled to one of a side of the duct and a side of the duct-covering part; and

a hall sensor that is coupled to the other of the side of the duct and the side of the duct-covering part and that is configured to sense a magnetic field of the magnet.

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